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Statements Relating to a
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THE NAVY YARD

IN THE

DELAWARE.

STATEMENTS

RELATING TO

A NAVY YARD IN THE DELAWARE,

FOR THE CONSTRUCTION AND EQUIPMENT OF

IRON-CLAD STEAM-SHIPS OF WAR,

PROPOSED TO BE ESTABLISHED

AT LEAGUE ISLAND.

PREPARED BY A SPECIAL COMMITTEE OF THE BOARD OF TRADE OF PHILADELPHIA.

PHILADELPHIA:

COLLINS, PRINTER, 705 JAYNE STREET.

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THE NAVY YARD IN THE DELAWARE.

THE attention of the Naval authorities has for some time past been directed to the selection of a site for more extensive operations, particularly in iron steam-ship building, than are practicable at any of the existing Navy Yards of the United States. The most hasty inspection of the Atlantic coast and harbors indicates the Delaware Bay and River as the natural choice for such a Navy Yard, unless insuperable objections should appear on closer examination—objections arising in the depth of water, or the character of shore and bottom at the point of actual location. Geographically the Delaware is central; it is the most southern point available within the loyal States; it is entirely land-locked, and capable of defence, at least as long as the Capital itself, from any foreign attack. It is the natural outlet of the coal and iron regions; it is the central point of supply of ship timber; it is nearer the great grain and provision producing interior than any other seaboard location. All supplies, and all forms of labor are at their minimum of price, and abundant beyond any possibility of exhaustion.

It was not merely a NAVAL STATION for a fleet that was desired. It was a great central workshop for the CONSTRUCTION OF AN IRON-CLAD STEAM NAVY, which was contemplated by the Secretary, in his letter of the 9th June, 1862, addressed to the Congress of the United States; and to which that body responded by the passage of the Act of 15th July, 1862, entitled "An Act

to authorize the Secretary of the Navy to accept the title to League Island, in the Delaware River, for Naval purposes."

It could hardly be possible that the Naval authorities should avoid making preliminary selection of the Delaware; and having done so, that they should take all requisite steps to confirm the selection; and to ascertain whether insuperable objections would be found, not apparent without close examination. An act of Congress being requisite to the purchase of a site, and necessary also to the acceptance of title to League Island, —which (on intimation that it was the choice of the Naval authorities) was tendered as a site, without cost to the Government, by the City of Philadelphia:—it was provided in the Act that a Commission should examine and report to the Secretary of the Navy the facts disclosed by a close and thorough inquiry, to enable him to comply at once with the law and the requirements of the public service. By an amendment to this Act the Commission was instructed to examine two other sites, suggested in Congress, by members of that body, and not by the Naval authorities.

In the course of the examination prosecuted by this Commission, it became the duty of the friends of the original selection in the Delaware, to lay before it a brief statement of the reasons affecting the case, and in their judgment controlling it. This statement is, in substance, though not precisely in form, reproduced here; taking up the principal points nearly in the order chosen by the Commissioners, in a series of inquiries propounded by them.

I.

SHIP TIMBER.

Central and Eastern Pennsylvania, with the vicinity of the Delaware Bay and river in the States of Delaware, Maryland, and New Jersey, constitutes now the great source of supply of ship timber to the Atlantic coast of the United States, live oak and Southern yellow pine excepted. New York and Maine are particularly dependent on this source of supply for oak and mast timber.

The interior, at the sources of the Susquehanna River, has an inexhaustible supply of white pine mast and spar timber, white pine plank stock and decking, all of the largest size. There is also an abundant supply of a variety of yellow pine, scarcely second to the Southern yellow pine in strength and durability, brought from the Susquehanna region; but less in size than the white pine.

The interior valleys also furnish the best long oak for keels, beams, long plank stock, &c., now known in the United States, as do the counties bordering on the Delaware, and parts of the States of Delaware and Maryland. This district is celebrated for its superior oak, great quantities being cut for export to England; and no other part of the United States within reach of tide water now yields oak of the requisite size for ship frames.

Most of this oak and pine reaches the Delaware from the Susquehanna River in timber rafts, though some is brought by railroads and canals to the Schuylkill and Delaware Rivers. Oak knees are most abundantly produced near the Delaware, and are brought by various modes.

The following designations of timber for Navy Yard supply are now chiefly drawn from the sources named above:—

1. White oak logs.	7. Yellow pine (of Penna.) logs, &c.
2. " keel pieces.	8. Ash logs, plank, and oars.
3. " promiscuous timber.	9. Hickory butts and hand spikes.
4. " plank (cut here).	10. Black walnut and cherry.
5. White pine mast and spar timber.	11. Locust (stanchions and trenails).
6. " logs (plank and decking).	12. White oak staves and heading.

The following additional designations of timber are at least as abundant here as at any other point:—

1. Cedar. 2. Poplar. 3. White heart hickory.

The sources of supply of live oak, Southern yellow pine, cypress, and other semi-tropical timbers, are of course the same here as at other points on the Atlantic coast.

Black spruce, spar timber is obtained from Maine and the British Provinces. This is the only description of ship timber required for naval purposes now brought from those sources, hackmatack knees being used only in small merchant vessels.

The quality of the ship timber of Pennsylvania is in all respects superior. *First.* The oak is superior to all others in length, and in solidity and durability. The length is nearly double, on the average, to that cut in Maine; and as described in timber bills for Eastern ship builders, is, for keelson, streak, and planking, "35 to 50 feet," with special lengths beyond these. The Delaware oak is also celebrated for its strength and durability, qualities attested by the preference long shown, both by Eastern and English ship builders, by the extraordinary strength of ships built here (*vide* Cope's and Penrose and Burton's ships), and also by the well known principles applying to this climate, soil, and the open field growth peculiar here.

Second. The pine of the Susquehanna is superior in size and in

quality. Masts of 70 to 80 feet in length and of 26 to 42 inches diameter (dressed) are easily and regularly obtained. The lands from which they are cut are inexhaustible for a century. The planking is considered stronger than that cut from Canada pine. Pennsylvania yellow pine is abundant, clear, makes excellent spars, and plank, declared by our ship builders equal to the best Southern. It dresses smaller than white pine, and has a share of sapwood to be removed.

Masts and spars are regularly supplied in all timber bills for ships to be built at New York and in Maine; they are sent in rafts, unfinished, to New York, through the New Jersey canals; and are sent dressed to the West Indies for repair of dismasted vessels.

II.

IRON—ITS PRODUCTION AND COST.

The hydrographic basin of every river in Pennsylvania is a source of iron supply. In the valley of the Schuylkill, fifteen miles from League Island, furnaces are in blast making pig iron from ores mined near by. From the Eastern Counties of Pennsylvania, our rail and water routes, home-made iron of every kind and quality, and in any quantity, can be delivered at Philadelphia. As to the *price* of iron, it is sufficient to say that the prices of American iron are always lower in Philadelphia than in any other city on tide water. Pig iron is manufactured at less cost per ton on lines of communication which terminate in Philadelphia, than at any spot outside of Pennsylvania. The price of iron depends of course upon the condition of the market; when fuel is cheapest the cost of the manufacture of pig metal is lowest; and when the demand is active the price of iron tends upward. It is said that pig iron has been made in the vicinity of Lebanon,

in Eastern Pennsylvania, at a cost not exceeding eleven dollars a ton—fuel being very cheap at the time. Seventeen dollars is a low price for pig metal, of the kind and quality made in the Furnace regions on the Schuylkill and Lehigh, and may be regarded as its minimum price in the Philadelphia market, in regular transactions twenty-five dollars per ton being its maximum price. From the furnaces to Philadelphia transportation is cheaper than to any other market, and hence prices are always lower in Philadelphia than in any other seaport city.

In and near Philadelphia and throughout the State of Pennsylvania every description of iron is manufactured, and is sold at prices which are enhanced by the addition of cost of transportation to points beyond the State; in short Pennsylvania *makes* iron cheaper than any other State, and Philadelphia *sells* iron cheaper than any other city.

The United States Census of 1860 gives the following statistics of the production of Iron:—

“The quantity of Pig Iron returned by the Census of 1860 was 884,474 tons, valued at \$19,487,790; an increase of 44 per cent. upon the value returned in 1850.”—“Pennsylvania makes 62.5 per cent. of the quantity, and 58.6 per cent. of the value of the whole production.” By Table No. 9 of the Census report the comparison is as follows:—

	Tons of Ore.	Tons of Pig Iron.	Value.
Pennsylvania	1,706,476	553,560	\$11,427,379
All other States	807,806	330,944	8,060,411
<hr/>	<hr/>	<hr/>	<hr/>
Total	2,514,282	884,504	\$19,487,790
Pennsylvania over all others	898,670	222,616	\$3,366,968
Connecticut has	20,700	11,000	379,500

Of Bar and other Rolled Iron the following is the comparison:—

	Tons.	Value.
Pennsylvania	259,709	\$12,643,500
All other States	146,589	9,605,096
<hr/>		
Total	406,298	\$22,248,596
Pennsylvania over all others	113,120	3,038,404
Connecticut has	2,060	175,500

III.

COAL.

Coal is brought to Philadelphia direct from mines in Pennsylvania, over six carrying lines, three canals and three railroads, the principal one of which is the Philadelphia and Reading Railroad; the second one the Schuylkill Canal; both of which carriers have descending routes (as also have two of the other lines) from the coal region to Philadelphia. .

The Coal Fields are nearer to Philadelphia than to any other city on tide water, and from the mines, transportation is cheaper to Philadelphia than to any other seaport; hence, mineral fuel can always be obtained in Philadelphia at lower rates than in any other city along the seaboard. Of the coal annually brought down the Schuylkill valley, from the Schuylkill mines to Philadelphia, *nearly a million tons are forwarded through Philadelphia to New York City and its adjacencies*, and this could not be done if the difference in favor of Philadelphia were not equal to the cost of transportation from Philadelphia to New York City and its neighborhood, say one dollar per ton.

At Mauch Chunk, a principal shipping point in the Lehigh coal region, at date April 1, about which time the season of navi-

gation begins, the Lehigh Coal and Navigation Company sold their lump coal, best quality, to iron furnace owners at the prices, to wit:—

1862,	April 1,	\$1.75	per ton of 2240 lbs.	
1861,	"	1.85	"	"
1860,	"	1.85	"	"
1859,	"	1.70	"	"
1858,	"	1.85	"	"

Average for five years, \$1.80 per ton.

Hazleton Lump Coal, best quality for furnaces, delivered at Mauch Chunk at same dates, at prices so nearly corresponding with the above, that the average is \$1.80 $\frac{5}{6}$ per ton.

From Mauch Chunk, April 1, 1862, commencement of Canal Navigation, the cost of transporting coal to Philadelphia, including all charges, to wit: Toll, freight and steam towing, was \$1.25 per ton. At date, April 1, 1862, the cost of Lehigh coal, best quality, delivered in Philadelphia, was \$3.00 per ton of 2240 pounds. Farther eastward coal is sold by the net ton of 2000 pounds.

At Schuylkill Haven, a principal shipping point in the Schuylkill region, where there is a railroad with a descending grade to Philadelphia, and a canal with a descending lockage to Philadelphia, a facility and advantage possessed by no other city on tide water, at date, April 1, the spring time of Canal Navigation, the cost of *Black Heath Coal* and *Locust Mountain Coal*, both celebrated coals, was as follows:—

1862,	April 1,	\$2.05	per ton of 2240 lbs.	
1861,	"	1.90	"	"
1860,	"	1.90	"	"
1859,	"	1.90	"	"
1858,	"	1.85	"	"

Average cost for five years, \$1.92 per ton.

From Schuylkill Haven, April 1, 1862, the toll and freight on coal carried by canal to Philadelphia was one dollar per ton,

which, added to the cost of coal at Schuylkill Haven, gives the cost of coal at Philadelphia at the date named.

These prices to be sure are minimum prices; still, whatever may be the prices prevailing in the general tidewater market, Philadelphia prices, as compared with other seaport prices, are always lower in amount, equal to the difference in the cost of transportation from the several mining regions to the different markets.

From the anthracite and semi-anthracite basins in the Susquehanna Valley, and from the semi-bituminous and bituminous basins in the Juniata and West Branch Valleys, there is direct communication with Philadelphia by railroad and by canal. And from Western Pennsylvania the Pennsylvania Railroad carries annually to tidewater very many tons of the best gas coals mined in the United States, which coal is also extremely valuable for steam generating purposes in all forms of engines.

Moreover, Cumberland Coal mined in Maryland can be delivered at League Island for one dollar per ton less price than in New York City or its vicinage.

Broad Top Coal, which is adapted to all the use to which Cumberland Coal is or can be successfully applied, is shipped from Huntingdon in cars and boats to Philadelphia, upon routes wholly within the State of Pennsylvania.

About one-third of the geographical area of Pennsylvania (which comprises 47,000 square miles) is coal territory, and of all the coal mined in the United States, three-fourths is mined in Pennsylvania.

The Preliminary Report of the Census of 1860 has the following statistics of the production of Coal in the United States:—

	Tons Bituminous.	Value.	Tons Anthracite.	Value.
Pennsylvania .	2,679,772	\$2,833,859	9,397,332	\$11,869,574
All other States .	3,162,787	4,692,822	1,000	5,000
Total .	5,842,559	\$7,526,681	9,398,332	\$11,874,574

Aggregate of Anthracite and Bituminous:—

	Tons.	Value.
Pennsylvania	12,077,104	\$14,703,433
All other States	3,163,787	4,697,822
Pennsylvania over all others .	8,913,317	\$10,005,611

IV.

POPULATION—LABOR AND MILITARY POWER.

The vicinity of Philadelphia and the Delaware River is the most populous district of the seaboard, New York only excepted. Within a circuit of thirty-five miles from the proposed site at League Island the aggregate population is nearly *one million*. Philadelphia alone has 600,000; the adjacent counties of Pennsylvania—Delaware, Chester, Bucks, and Montgomery, 150,000 more; the city of Wilmington and county of New Castle, in the State of Delaware, 50,000 more; the cities of Camden and Trenton, with the best parts of five counties in New Jersey, more than 150,000 in addition. From the Delaware River near Wilmington the distance to Baltimore is but 65 miles, with easy access by railroad and canal. The exact population of this district by the census of 1860 is as follows:—

In Pennsylvania—Philadelphia	565,529
Delaware County	30,597
Chester County	74,578
Montgomery County	70,500
Bucks County	63,578
	—————
In New Jersey—Burlington County	49,730
Mercer County	37,419
Camden County	34,457
Gloucester County	18,444
Salem County	22,458
	—————
In Delaware—New Castle County	54,797
	—————
Total population	1,022,087

MILITARY POWER.

The ratio of persons liable to military duty is very nearly one-sixth. In Philadelphia alone the number is more than 100,000, by the most careful calculation and correction of the Marshal's returns. The same proportions give, in a total population of 1,000,000,

NOTE.

The United States Marshal's enrolment in August, 1862, of persons liable to military duty was

For Philadelphia, 100,754:	In service as volunteers, 19,505
" Delaware Co., Pa. 6,052:	" " 1,540

In Philadelphia the Draft Commissioners declared exempt from draft, of those enrolled, 16,397, leaving 86,367 liable. Add to these the number in service as volunteers, and we have 86,367

In service as volunteers	19,505
In marine and navy	1,861
	—————
Total military force of Philadelphia,	107,733

Which is eighteen per cent. of the whole population. The same proportion in the whole area, having 1,000,000 inhabitants, would give 180,000 as the military force.

166,600 liable to military service. The military power of such a district far exceeds that of any other similar area of the United States, except the immediate vicinity of New York. It is clearly sufficient for any possible contingency of danger to a great Navy Yard.

THE LABOR POWER.

Next to military power as a consideration in locating great public works, are the facilities for obtaining the requisite labor, skilled and unskilled. The labor chiefly required at a Navy Yard of the kind proposed here, is that of ordinary ship builders, and of engine builders and iron workers. Both these classes are already occupied here in larger numbers than in any other locality.

In regular ship building, the present Navy Yard at Philadelphia employs an average of near two thousand persons, all on timber work. Other ship builders of the city employ at least as many more; while the small towns of the Delaware River below—Chester, Wilmington, New Castle, and others—employ a large number in addition. The aggregate of skilled workmen in ship timber in and near Philadelphia cannot be less than *five thousand*, while a remunerative demand arising here in addition to the employment at present given, would bring a much larger number at once.

SKILLED LABOR IN IRON AND MACHINERY is relatively far more abundant at Philadelphia than any other, and it is the especial requisite to the erection and operation of a great Iron shipbuilding establishment. By the Census of 1860 there were employed in iron and steel manufactures, in Philadelphia alone, 10,917 men, with a capital of \$10,290,125, and a production of \$14,775,213. In the adjacent townships, within a very few miles,

Manuscript Add. 1800.

there are thirty-four forges, foundries, and rolling mills in addition, employing 2,430 men, and producing \$3,888,151 annually.

There are six conspicuous iron steamship building works; four establishments at which heavy ordnance are made, of wrought and cast iron; and several establishments casting shot and shell. The capacity of these works is enormous. Two extensive manufactories of small arms exist, one recently erected, and capable of turning out a quantity second to the Springfield Armory only. The following is a list of the number of works conspicuous for their extent in the leading classes:—

Heavy Machinists' tools, Iron planes, drills, &c.	Two.	2
Forges, for ship shafts, and heavy plate and axles	Three.	3
Rolling Mills; bar, plate, and sheet	Twelve.	12
Heavy Ordnance foundries	Two.	2
Manufactories of Small arms	Three.	3
Heavy Ordnance, wrought	One.	1
Shot and Shell foundries	Three.	3
Shipping Foundries and Iron Shipbuilding establishments	Seven.	7
Steam Engines and general Machinery	Fifty-three.	53
Locomotives, Axles, and Car Wheels	Four.	4
General Foundries and Building Foundries	Twenty-five.	25

The following, from the U. S. Census of Manufactures for 1860, gives the aggregate of all the establishments in Iron manufacture then existing; the manufacture of ordnance and arms having been commenced since that time:—

	No. Establishments.	Capital invested.	Hands employed.	Value of Production.
General Foundries; pipes, hollow-ware, &c. &c. . . .	45	\$1,773,150	1,778	\$2,366,683
General Machinery; Ship Machinery, Steam Engines, Locomotives, &c. . . .	105	4,932,600	4,617	5,598,656
Rolled Iron; bar, plate, &c. . .	19	1,133,000	1,311	2,338,777
Wrought Iron; Smithwork, sheet-iron work, &c. . . .	376	1,435,825	2,020	2,633,469
Steel Works, and various manufactures of steel, &c. . . .	105	1,015,550	1,191	1,837,658
Manufactures in part of Iron and Steel; Cars, Carriages, Wagons, &c. . . .	190	1,961,050	2,529	2,930,733
Iron Manufactures in adjacent townships within a few miles of Philadelphia:—				
Furnaces and Forges	12	\$777,000	376	\$833,800
Foundries	4	233,000	210	288,000
Rolling Mills, on bar, rails, sheet, and plate	12	1,917,610	1,680	2,611,251
Machinery and Tools	6	117,000	153	142,600
Totals	874	\$15,295,785	15,865	\$21,581,627

V.

MAINTENANCE OF LABOR—RESIDENCES, PROVISIONS, ETC.

Prominent among the questions affecting the establishment of extensive public works, are those concerning the maintenance of the men necessarily employed. If no facilities exist for the ready housing and provisioning of thousands of men employed on public works, they cannot be readily gathered, or be kept in employment except at high wages. These questions have been considered, it is believed, in the action already taken, and the

result is overwhelmingly in favor of a Naval site on the Delaware.

The site proposed at League Island, is practically a part of the city of Philadelphia. It is but two miles from portions of the city already densely built up, and the intervening space is peculiarly favorable to the natural extension of the city. In the natural progress of population one-half of this intervening area will be built over within a very few years.

Philadelphia has long been celebrated for the superiority of the dwellings occupied by workmen of all classes. Hundreds of streets are built up with neat and comfortable brick houses, the rent of which is from four to eight dollars per month, and which are occupied under circumstances of peculiar comfort. Employers here are always able to command skilled labor in greater abundance than elsewhere, for this among other reasons. This superiority, both in cost and in comfort, of buildings for the residences of men in every grade of employment is, and has long been, the admiration of Europeans as well as of the people of other parts of the United States.

Communication with the site of the Navy Yard, from all parts of the city of Philadelphia, will be as easy, from the outset of its establishment, as with any other part of the city. The admirable passenger railway system already has charters awarded to cover the extension of a road to that point, and as the distance is but two miles, or less than half the distance through the city in any direction—less than half the average length of the passenger railroads now traversing it;—it is absurd to suppose that communication with League Island will be subjected to serious difficulties. In fact, the thousands of skilled workmen to be employed there, will, in most cases, not be required to change their residence at all, or can do so only in their own time and at their own convenience in every respect. The passenger railway system of Philadelphia is perfected to a degree no other city can expect to attain.

It traverses almost every considerable street of the city, and in several cases extends for miles beyond, in the country and suburban towns. The rate of fare is often far below the rate on railways in general, five cents sufficing for as many miles.

Provisions are at their minimum of price at Philadelphia as compared with any other city or point of the seaboard. The local markets have long been celebrated for their profusion and cheapness, and the extent of the highly cultivated country from which they are supplied, increases even more rapidly than the population. Intermediate between the northern and southern extremes, they have the advantage of both, without their disadvantages. Supplies of perishable provisions come early and remain late; they are always abundant and always cheap.

Grain and flour can be laid down from Chicago, or any other great exporting point, on an average fifteen cents per barrel cheaper at Philadelphia than at New York. All other heavy freight in provisions, beef, pork, bacon, &c., is equally capable of cheap delivery. Such stores are, and always have been, cheaper to purchase in this market for European or tropical export than in any other of the Atlantic coast. The distance traversed from the great provision producing districts of the interior to Philadelphia is *ninety miles* less than to New York, and therefore, no other market can have equality with this in prices and facility of purchase of these essentials of a depot of government supply. Any city or locality of the New England coast must be at disadvantage in this respect by not only the cost of carriage from Philadelphia, but by all the additional difference caused by want of regular market and regular supplies.

These are but few of the reasons why a great public establishment on the Delaware near Philadelphia, would be peculiarly favored in all that relates to the cost and supply of labor, the maintenance of men, and the abundance and cost of stores of provisions.

VI.

WATER STORES AND SUPPLY.

Fresh water in abundance for ship supply, is also a requisite in a great naval establishment. The Delaware River, at League Island, is peculiarly favored in this respect. The mean point of brackishness is very nearly at Wilmington, Delaware; and brackish water never comes within ten miles of League Island. Ships are accustomed to take in water at all points below the junction of the Delaware and Schuylkill down to Marcus Hook, a distance of fifteen miles. The water of the two rivers is also peculiarly valuable for ship supply, and it has long been celebrated for its facility of long preservation. Shipping from the New England ports prefer it, and take in supplies for the round voyage, if possible. Vessels in the trans-Atlantic trade do the same, particularly packets regularly trading to British ports. There is no better water, nor are facilities to procure water, for shipping supply, anywhere equal to those of the Delaware River at and below the site of the proposed yard.

WATER FOR DOCKING PURPOSES.

Ample dock room, in fresh water, is indispensable for vessels of all classes, but particularly for ships built of iron. The whole of the broad bay formed in the Delaware at League Island is available as anchorage ground for vessels merely waiting orders, and the island, both on its front and sides, affords peculiar facilities for the construction of docks. The tide is six feet, and always without violence of current or roughness of sea. The whole circuit of the island could be employed for the dockage of ships, with but a small amount of excavation.

The destructiveness of the *teredo*, or ship worm, has become extreme in all salt-water yards and bays, such as Norfolk. These scourges increase in numbers and destructiveness every year, and it often requires but two or three years of service of an ordinary vessel, to effect the ruin of its best timbers. A piece of the timbers of a vessel which made its first voyage from Philadelphia in June, 1862, and remained in the waters of the vicinity of Fortress Monroe until October 1st only, is cut into a complete honey-comb. Such is the rapid work of the salt water ship worm; more rapid in the Chesapeake than in Northern waters, but abundant in all salt water. Fresh water destroys them.

The effect of salt water on iron ships is as yet imperfectly known, but it must be severely adverse to their durability when under construction, or laid up, at least. The harbor of Philadelphia and at League Island is the only one in the United States that is at once ample in capacity and perfectly secure. Iron ship-building is just at the entrance to a career of unknown extent; it is only known that iron must very largely, and possibly almost entirely, supplant wood in the building of vessels of every class required in the government service. Iron vessels cannot be built with economy, or even safety, where ample fresh water docks are not at hand. The government has recognized this necessity in the action already taken.

VII.

MINOR SUPPLIES—STONE, LIME, BRICK, &c.

Quarries of a kind of gneiss or blue rock, passing by insensible gradations into a very good granite, exist on the borders of the Delaware River, a very few miles from League Island only. Access to these quarries is easy; the stone is abundant beyond

any possibility of exhaustion; and transportation to the locality where they are wanted could nowhere else be so cheap, the quarries being at the water's edge. Dimension stone, of any requisite size, can be quarried in abundance, weighing one to ten tons. Rough stone, for inner walls, are still more abundant in the same quarries. Granite from eastern quarries can be brought to Philadelphia actually cheaper than to New York or New London, because of the great number of vessels coming in ballast here for coal. Granite is therefore as cheap at Philadelphia as at Boston, nearly.

Lime is made on the Schuylkill River, a few miles above Philadelphia, more abundantly than anywhere else in the United States. It is, in consequence of its abundance and superior quality, exported to New York; to Eastern ports; to Maryland, for agricultural purposes; and even to foreign countries. The Great Valley, so called in the geology of Pennsylvania, which is intersected by the Schuylkill River fifteen miles from its mouth at League Island, contains a belt of limestone sixty miles long and nine miles wide, measured along the Schuylkill Canal and Reading Rail Road, both of which works run through it. The North Pennsylvania Rail Road also crosses this belt thirteen miles from the city; but the great lime works are along the Schuylkill.

By the census of 1860, eight quarries on the Schuylkill near Philadelphia, employing 240 men, produced as follows:—

Lime.	Marble.	Limestone.	Total value.
1,913,000 bushels.	50,000 cubic feet.	37,000 tons.	\$237,000.

One establishment alone made 700,000 bushels of lime.

Bricks are well known as being made in great abundance and superiority at Philadelphia; facts attested by their export to almost all parts of the United States. The census of 1860 reports 54 works within the chartered limits of the city, employing 1975 men, and making an aggregate value of \$1,290,096 of "pressed, common, and fire brick."

VIII.

CONDITION OF THE RIVER: DEPTH OF WATER, ICE, &c.

The Delaware River has everywhere great depth and capacity for an inland stream. The tide rises and falls six feet, constituting a current sufficient to preserve the channel against sedimentary deposits. In front of the city of Philadelphia the depth of water is remarkable, varying from twenty to the very extraordinary depth of sixty feet at the pier heads; several piers ending in water fifty-seven feet deep at low tide. The strong current maintains this depth with ease, in part because the Delaware itself is free from the usual excess of sediment brought by great rivers from the interior. In front of League Island a space of more than a mile and a half in length is swept by a similar current, over a firm clay and gravel bottom, maintaining a three fathom depth within a hundred and fifty yards of the shore for the whole distance. The area off this front is very large with four fathoms of water at low tide. It has been surveyed and sounded with accuracy by the United States Coast Survey, and a comparison of the charts of the two bays shows the four fathom water of the Delaware at League Island to be nearly three times as great as the area having the same depth in the bay at New London, Connecticut, a place that has been mentioned as having the best water of any northern location. The shoal water is also extremely small in area in the Delaware generally, and in particular at League Island.

The channel in the Delaware has been greatly improved within two years past, at a point previously somewhat difficult, near Fort Delaware. On the west of the island on which that fort is located the channel shoaled to 17 feet at low water, but at the same time the old channel east of the island, opened deeper than before,

and now carries 22 feet at low water over the only bar, having, for most of the distance difficult of passage on the west side, a much greater depth, and a perfectly straight line.

The capacity of the Delaware for ships of the greatest draught known was fully attested by the easy entrance of the ship Cathedral in 1856, which had waited at New York for days without being able to get over the bar, and its equally easy and safe exit with a cargo. With the tide a draught of 26 feet may be easily brought up, but beyond 20 feet the question becomes unimportant, since vessels of great depth of draught will not be built in future, and none now possessed by the government find difficulty in using the Delaware River and the harbor of Philadelphia. A narrow bar near Fort Mifflin presents the greatest difficulty to a ship of deep draught, probably, the channel deeper than 18 feet at low tide being very narrow; but the whole bar is easy of removal in case it should be deemed requisite to improve that point. Practically the difficulty of passing it is not greater than that of the bars off Sandy Hook, at the entrance of New York outer harbor.

ICE IN THE DELAWARE.

Very much has been said of obstructions to the navigation of the Delaware from ice, and a degree of importance has been attached to the point wholly unwarranted. Like all harbors and rivers of the Atlantic coast, ice forms freely in extreme winters, often covering the river in front of Philadelphia, and sometimes seriously obstructing navigation at a point called the Horse-shoe, between the city and League Island. At and below League Island it is never out of the power of an ordinary Ice Boat to maintain navigation without interruption, admitting easy entrance and exit for sailing vessels of every class. The very unusual severity of the winters of 1855-6 and 1856-7, has exaggerated the fear of ice in all our harbors. The winter last named had

but two precedents in the history of the country; which were the winters of 1740-41 and of 1779-80, in both of which Long Island Sound was frozen over from Fisher's Island to the main land, near New London, so that sleighs passed over it. The ice formed in Boston harbor for several miles out among the islands, also: at New York the rivers both closed with ice, and heavily laden teams crossed to and from Staten Island. The Potomac at Washington was frozen so that a locomotive engine was taken across on the ice in 1856; and in that and the former years named, the Potomac, the James River, and large areas of the upper Chesapeake Bay were solidly frozen. The intervals at which the Delaware River at and below League Island would be seriously obstructed by ice, cannot be more frequent than once in thirty or forty years. At the Horse-shoe shoal the ice might accumulate more frequently, perhaps as often as once in fifteen or twenty years, and in front of the city the practical obstruction might be somewhat more frequent.

As a practical objection to the location of a Navy Yard at League Island this appears to be entirely out of the question, and it may be demonstrated to be such by comparing the records of temperature here with those at other and northern points. With a climate so largely in our favor as the mere difference of latitude creates, and as is proved by our well-known exemption from the severity universally prevailing at and north of New York, it is not easy to believe that the Delaware River, remarkable for its mildness of climate, will be avoided because of absurd fears of obstruction by ice.

IX.

LEAGUE ISLAND: ITS SURFACE, ETC.

It has been objected that the surface of League Island is too low, and the foundation too soft for extensive works. Persons who have never seen it have reported it as a reclaimed marsh, and an island formed by changes of current in the river. Such is not the case; the island being an original formation, and in fact a part of the main land, separated by a narrow channel only. It was firm land at the first occupation of the country by English colonists, and was taken up by a Land Company of London in 1699, a fort being erected on it for defense. It was occupied as farms as early as 1705, and titles descending from these have been regularly derived by a number of occupants and residents down to the present time. The old Island, farmed and occupied in this way for a hundred and fifty years, contained 235 acres by the original and official survey of 1699. It was, from the beginning, protected against extreme high tides by an embankment of earth, now made a strong stone wall. Within the last fifty years a "New Meadow" has been reclaimed and added to the original Island on the western or Schuylkill side. This new portion contains 174 acres, and is enclosed by a strong stone wall. Though having the same foundation of clay and gravel as the old Island, the depth of alluvial soil is greater on this new portion.

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The old island has an average of perhaps 16 feet of alluvial soil and clay; below which is firm gravel and clay, such as underlies the whole peninsula on which Philadelphia is situated. On this soil oaks, scarcely less than three centuries old, are growing. The soil is nowhere spongy or marshy. The grasses

grown over the whole island, old and new, are dry meadow grasses exclusively, clover and timothy; and the crops are heavy and unfailing. Though the surface is below the reach of the highest tides, the drainage is perfect, and floods or overflows never occur. Borings disclose a succession of firm strata throughout, and those undertaken by the Naval Commission to test the reclaimed portion of the island, only show a few feet more of mixed clay and alluvial soil on the top. Firm clay, gravel, and sand underlie the whole island and all its surroundings of marsh and river surface. The bottom of the Delaware is everywhere firm, affording good holding ground, and firm clay is excavated on the Schuylkill side in all dredgings there undertaken.

For such filling as should not be supplied from natural dock excavation on the island itself, there is an inexhaustible supply of the best gravel and clay in the adjacent lands on both sides of the river. The cost of filling a cubic yard deep, would be but about \$1.200 per acre; or less than the cost of excavating and removing high shores. Refuse excavations from the city would also afford a supply of filling material without cost. Little or no dredging would be required in front of the wharves and docks, the depth of water everywhere being great, and nearly the exact requisite.

The proximity of New London to the ocean, and its accessibility to hostile approach from that quarter, would render it insecure as a site for a great Navy Yard. It would be particularly indefensible against steam iron-clad frigates of modern construction. In 1812 Forts Trumbull and Griswold proved insufficient to protect it against wooden vessels, and they would serve far less efficiently against iron-clad ships. No such apprehension can reasonably be felt in regard to Philadelphia. The Delaware

bay and river have never been successfully entered by a hostile fleet, though affording deeper water than the entrance to almost any other harbor of the Atlantic Coast. The Government obviously regards a Navy Yard in the Delaware as absolutely secure from attack by an enemy.

The deficiency and expensiveness of timber grown in the neighborhood of New London, and the necessity of drawing it from remote places, is a positive objection to it as an eligible site for a Navy Yard; nor is the "Salisbury iron," though useful for certain purposes, when obtained at an extraordinary cost, sufficiently abundant to constitute an important item in the consideration of a suitable location for the construction of machinery and iron-clad ships.

The experience of the proprietors of the Collins' line of steamships in the use of this iron in the formation of shafts for the steamer *Atlantic* was not favorable to the adoption of iron of that quality in the building of machinery—the breaking of the shaft made of Salisbury iron in mid ocean greatly endangered the lives of the passengers and risked the loss of the vessel.

The abundance, variety and suitableness of Pennsylvania iron and coal, during the present emergency of the Government, has been sufficiently demonstrated by many practical tests, and it does not require any further proofs of the elasticity, tensile strength, and hardness of this metal to ensure its preference in the construction of the great guns in Pittsburg, and the further use of it in plating vessels of war.





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